

10/28/16

"If you love what you have, then you have what you need."-Lisa Lopicollo

HW: Complex Fractions worksheet #3, 4, 5, 6, 10, 11
 Test 3 on Friday 11/4

AIM: How do we Simplify Complex Fractions?

Warm Up:

Perform the indicated operation and simplify (Dont forget to indicate restrictions)

$$1. \frac{a}{a+2} - \frac{-2}{\cancel{3-a} \text{ (a-3)}} - \frac{3a+1}{\cancel{a^2-a-6} \text{ (a-3)(a+2)}}$$

$$\frac{a(a-3)}{(a+2)(a-3)} + \frac{2(a+2)}{(a+2)(a-3)} - \frac{3a+1}{(a+2)(a-3)}$$

$$\frac{a^2 - 3a + 2a + 4 - 3a - 1}{(a+2)(a-3)}$$

$$\frac{a^2 - 4a + 3}{(a+2)(a-3)}$$

$$\frac{(a-1)\cancel{(a-3)}}{(a+2)\cancel{(a-3)}}$$

$$\frac{(a-1)}{(a+2)} \quad \text{a} \neq -2, 3$$

$$2. \frac{x^2-9}{27+3x^2} \cdot \left(\frac{x^2+x-6}{x-4} \div \frac{6-x-x^2}{3x-12} \right)$$

$$\frac{(x-3)(x+3)}{3(9+x^2)} \cdot \left(\frac{(x+3)(x-2)}{x-4} \div \frac{-1(x^2+x-6)}{3(x-4)} \right)$$

$$\frac{(x-3)\cancel{(x+3)}}{\cancel{3}(9+x^2)} \cdot \frac{(x+3)\cancel{(x-2)}}{\cancel{x-4}} \cdot \frac{\cancel{3}\cancel{(x-4)}}{-1\cancel{(x+3)}\cancel{(x-2)}}$$

$$\frac{(x-3)(x+3)}{-1(9+x^2)}$$

$$\frac{x^2-9}{-x^2-9} \quad x \neq 4, -3, 2$$

A fraction in which the numerator or denominator contains one or more fractions or negative exponents is called a *complex fraction*.

1. Simplify $\frac{\frac{3}{2} + \frac{3}{x}}{2 + \frac{4}{x}}$

1) Numerator LCD: $2x$

$$\frac{(\cancel{x})\frac{3}{2} + \frac{3}{\cancel{x}}(\cancel{2})}{(\cancel{x})\frac{3}{2} + \frac{3}{\cancel{x}}(\cancel{2})}$$

$$\frac{3x}{2x} + \frac{6}{2x} = \frac{3x+6}{2x} \leftarrow \text{New Top}$$

Method 1

Denominator LCD: x

$$\frac{(\cancel{x})\frac{2}{1} + \frac{4}{\cancel{x}}}{(\cancel{x})\frac{2}{1} + \frac{4}{\cancel{x}}}$$

$$\frac{2x}{x} + \frac{4}{x} = \frac{2x+4}{x} \leftarrow \text{New Bottom}$$

Steps

1. Combine fractions in numerator
2. Combine fractions in denominator
3. Rewrite as a division problem
4. Follow rules for division

3) Rewrite

$$\frac{\frac{3x+6}{2x}}{\frac{2x+4}{x}} \Rightarrow \frac{3(x+2)}{2x} \div \frac{2(x+2)}{x}$$

Keep Change Flip.

$$x \neq 0, -2 \quad \frac{3(x+2)}{2x} \cdot \frac{x}{2(x+2)} = \boxed{\frac{3}{4}}$$

Method 2

LCD: $2x$

$$\frac{(\cancel{2x})\frac{3}{2} + \frac{3}{\cancel{x}}(\cancel{2x})}{(\cancel{2x})\frac{3}{2} + \frac{3}{\cancel{x}}(\cancel{2x})}$$

$$\frac{(\cancel{2x})\frac{3}{2} + \frac{3}{\cancel{x}}(\cancel{2x})}{(\cancel{2x})\frac{3}{2} + \frac{3}{\cancel{x}}(\cancel{2x})}$$

$$\frac{3x+6}{4x+8} = \frac{3(x+2)}{4(x+2)}$$

$$\boxed{\frac{3}{4}}$$

Steps

1. Find LCD of all "little" fractions
2. Multiply entire fraction by LCD of all denominators
3. Simplify

$$x \neq -2, 0$$

⊗ With complex fractions check for restrictions at the very beginning and at the end right before we simplify.

$$\frac{10}{5} \Rightarrow 10 \div 5$$

Simplify each of the following.

LCD: $3w$

$w \neq 0, 6$

$6 - w \neq 0$
 $+w \quad +w$
 $6 \neq w$

2.

$$\begin{array}{r} \cancel{(3w)} 7 + \frac{1}{\cancel{3}} \cancel{w} \cancel{(3w)} \\ \hline \cancel{(3w)} 2 - \frac{1}{\cancel{w}} \cancel{3} \cancel{(3w)} \end{array}$$

$$= \boxed{\frac{7w + 3}{6 - w}}$$

7.

LCD: x
 $x \neq 0, 1$

$$\frac{\cancel{(x)} \frac{1}{\cancel{1}} - \frac{1}{\cancel{x}} \cancel{(x)}}{\cancel{(x)} \frac{x-2}{\cancel{1}} + \frac{1}{\cancel{x}} \cancel{(x)}} = \frac{x-1}{x^2-2x+1} = \frac{\cancel{(x-1)}}{(x-1)\cancel{(x-1)}} = \boxed{\frac{1}{x-1}}$$

8.

LCD: $a+b$
 $a+b \neq 0$
 $a \neq -b$
 $a \neq 0$

$$\frac{\left(\frac{a}{a+b}\right)\left(\frac{a+b}{1}\right)}{(a+b)\left(\frac{1}{1}\right) - \left(\frac{b}{a+b}\right)(a+b)}$$

$$= \frac{a}{a+b-b} = \frac{a}{a} = \boxed{1}$$

9.

$$\frac{1 + a^{-1}}{a - a^{-1}} = \frac{1 + \frac{1}{a}}{a - \frac{1}{a}}$$

$$(*) \quad a^{-1} = \frac{1}{a}$$

$$a^{-2} = \frac{1}{a^2}$$

LCD: a

$$\begin{array}{l} a \neq 0 \\ a \neq 1, -1 \end{array}$$

$$= \frac{(a) \frac{1}{1} + \frac{1}{a} (a)}{(a) \frac{a}{1} - \frac{1}{a} (a)}$$

$$= \frac{a+1}{a^2-1} = \frac{(a+1)}{(a+1)(a-1)} = \frac{1}{a-1}$$

$$16) \frac{4u^{-1} + (uv)^{-1}}{v^{-1} - 5} = \frac{\cancel{(uv)} \frac{4}{\cancel{u}} + \frac{1}{\cancel{uv}} \cancel{(uv)}}{\cancel{(uv)} \frac{1}{\cancel{v}} - \frac{5}{1} \cancel{(uv)}} = \frac{4v + 1}{u - 5uv} = \boxed{\frac{4v+1}{u(1-5v)}}$$

LCD: uv

$u \neq 0$
 $v \neq 0$

$1 - 5v \neq 0$
 $-1 \quad -1$

 $-5v \neq -1$
 $-5 \quad -5$

$v \neq \frac{1}{5}$

22)

LCD:
 $(y-2)(y+2)$
 $y \neq 2, -2$
 $y \neq -5$

$$\frac{(y-2)(y+2) \cdot \frac{1}{1} + \frac{7}{y-2} \cdot \frac{(y-2)(y+2)}{(y-2)(y+2)}}{(y-2)(y+2) \cdot \frac{1}{1} + \frac{3}{y+2} \cdot \frac{(y-2)(y+2)}{(y-2)(y+2)}} = \frac{y^2 - 4 + 7y + 14}{y^2 - 4 + 3y - 6}$$

$$= \frac{y^2 + 7y + 10}{y^2 + 3y - 10} = \frac{\cancel{(y+5)}(y+2)}{\cancel{(y+5)}(y-2)}$$

HW: #1-8, 31-33